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ABSTRACT

Researchers and two elementary teachers designed a cross-age tutoring program in which they examined the features and processes of peer interaction from a Vygotskian and Piagetian perspective. The study specifically focused on the following issues: characteristics of the tutor and tutee that are most likely to enhance learning; types of learning outcomes most amenable to cross-age tutoring; relationship between the task difficulty and the nature and quality of interactions between peers; and teaching strategies used by tutors during their scaffolding process. Ten cross-age dyads of fifth graders and kindergartners were paired by their teachers based on gender and teachers perceptions of children's academic ability as well as the school records. Meeting once each week for an hour, each tutorial session consisted of a warm-up activity (crossword puzzle), a major task (concept of measurement, concept of house as living space, two science experiments, and map construction), and an ending activity (card game). All dyads were video- and audio-taped for 5 consecutive weeks and the tapes transcribed verbatim. Results of in-depth and detailed analysis suggest that older peers can and do assist younger ones thinking in the course of tutoring, but also indicate that there are some limitations to how tutors can successfully scaffold to maximize tutees' learning. Excerpts from the tapes demonstrate specific patterns that emerged from analysis of the data. (Contains 5 tables and 13 references.) (JT)

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Cross-age Tutoring: Exploring Features and Processes of Peer-Mediated Learning

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Introduction

Research has shown that peer tutoring can support children's learning and socio-cognitive development (e.g., Azmitia, 1988; Brown, Anderson, Shillcock, & Yule, 1984; Wood, Wood, Ainsworth, & O'Mally, 1995). Peer-tutoring is a particularly significant new field of research investigating scaffolding procedures within the zone of proximal development. While recent research focusing on peer instructional processes demonstrates that children can be very effective teachers (e.g., Allen, 1976; Mehan, 1977), Rogoff and others (1988, 1982) argue that adult guidance is more beneficial to children's learning. Ellis and Rogoff (1982) examined the efficacy of child versus adult teachers during sorting activities. They found that even though the children's teachers possessed adequate knowledge of the material, the learners who were paired with adults scored higher on the post-test than did the learners taught by children. Moreover, the authors reported that adult teachers used more sophisticated instructional strategies compared to those of children's teachers. Adults used more verbal than nonverbal instruction, provided more group relationship information than information specific to task items and elicited greater participation from the learners. Similar results were also reported by Radziszewska and Rogoff (1988) and Rogoff (1990).

In spite of results of the studies which demonstrate that children learn more from interaction with adults than from peers, some researchers argue that *older* and *expert* peers can also facilitate development of children's cognitive skills and understanding (Azmitia, 1988; Tudge, 1992; Verba & Winnykamen, 1992). This is consistent with Vygotskian perspective which emphasizes the importance of pairing learners with older and more expert peers rather than with adults. In these studies expert is defined as being either an older peer or peers of higher ability. In a recent study, for instance, Verba and Winnykamen (1992) examined the interaction between pairs of unequal general ability and unequal domain expertise. They found that in pairs where the high ability child was the domain expert and the low ability child the novice, the interaction was characterized by tutoring or guidance from the high ability child. Whereas, in pairs where the high ability child was the novice, and the low ability child the expert, the interaction involved more collaboration and joint construction. The authors further note that it is not that some types of dyadic or group compositions are more effective than others; rather, it is the different mixture of the learners' knowledge, experience and general ability which are seen to be the effective factors in promoting group interaction and learning.

The contribution of peer interaction has been shown to be a function of asymmetry of relationships, affected by differential mastery of specific tasks and differences in partner status (Verba & Winnykamen, 1992). Azmitia (1988), for example, looked at domain expertise in pairs of five-year olds of equivalent abilities. He found that when novices were paired with experts on a model building task, they improved significantly during and following the interaction. In another study, examining pairs of three-, five- and seven-year old children, Wood, Wood, & O'Malley (1995) showed that children's ability to learn a task is correlated with both their instructional competence and their peer's learning.

Despite the contradictory results on the effectiveness of peer/adult tutoring, in general, Vygotskian and Piagetian research suggests that peers as well as adults may facilitate the development of children's skill and understanding. Furthermore, previous studies on peer-tutoring have exclusively focused on the conditions and products of the peer interaction instead of emphasizing the importance of the nature and the quality of the processes mediating this interaction. The present study is designed to address this gap by examining the nature and the dynamics of peer tutoring.

The Purpose of the Study

The purpose of this study was to explore the features and the processes of peer interaction from a Vygotskian and Piagetian perspective. It specifically focused on the following questions:

- What characteristics of the tutor and tutee are most likely to enhance learning?
- What types of learning outcomes are most amenable to cross-age tutoring? How would the task difficulty affect the nature and the quality of interactions between peers?
- What teaching strategies were used by tutors during their scaffolding process?

Theoretical Framework of the Study

Vygotsky's socio-cultural approach provides a framework in which the role of tutors and the interactive processes can be examined. According to Vygotsky, higher mental functions appear first on the social level between people, and later on an individual level, within the child. "Human learning pre-supposes a specific social nature and a process by which children grow into the intellectual life of those around them" (1978, P. 88). Vygotsky theorizes that development is most likely to occur when two participants differ in terms of their initial level of competence about some skills or tasks. A critical concept in the Vygotskian perspective is the *zone of proximal development*, the area of development in which the child can be guided in the course of interaction with a more competent partner (either adult or expert peer). At the base of Vygotsky's zone theory is the concept of *mediation*. It is through social dialogue with knowledgeable others that children's higher order thinking shapes and develops. Inspired by this theory, we assumed that cross-age tutoring may be as conducive to learning as adult-child tutoring. Moreover, by pairing an older peer with a younger peer, this study attempts to draw a closer link between Vygotskian and Piagetian perspectives. While Piaget argues that the interaction between a child and an adult is essentially unequal and detrimental to cognitive growth, Vygotsky emphasizes the importance of pairing learners with capable/expert others. Piaget further argues that the child-adult asymmetrical interaction disrupts the condition of reciprocity for achieving equilibrium in thinking (Piaget, 1977). On the same line, an older peer is less likely to create an unequal power relation during interaction while serving a function like that of adults in interaction as suggested by Vygotsky.

Methodology

The study employed a qualitative approach. It was a collaborative effort between the researchers and two elementary teachers who designed a cross-age tutoring program (a "buddy" program) at their school. A detailed and in-depth analysis was utilized to examine the interactive processes between peers during tutorial sessions. Within the program, fifth graders and kindergartners split their classes once each week for approximately one hour. The participants were ten cross-grade dyads ranging in age from 5.7 to 10.3 years old. Of the twenty children (nine boys and eleven girls), seventeen were White and three were African American (two girls and one boy). Dyads were paired by teachers based on their gender and teachers' perceptions of children's academic ability as well as the school records. Dyads were assigned to either same-ability or mixed-ability condition. Each tutorial session consisted of a warm-up activity (cross-word puzzle), a major task (concept of measurement, concept of house as a living place, two science experiments and map construction) and an ending activity (card game). The purpose of the warm-up activity was to allow students to begin their interaction process while improving their vocabulary. The major tasks were designed around the concepts and thinking skills that teachers thought were important based on kindergarten and fifth grade curricula. Both kindergarten and fifth grade teachers had identified specific learning outcomes for each task. In other words, with the completion of each task kindergartners and fifth graders were supposed to accomplish specific goals. The goals of some tasks, however, seemed to focus more on fifth grade skills and the goals of other tasks on kindergarten capabilities. Table 1 summarizes the tasks, their planned procedures, and the identified learning outcomes for each grade level. The ending activity (card game) was designed to provide opportunity for each dyad to interact together at a more social level.

All dyads (see table 2) were video- and audio-taped for five consecutive weeks during tutorial sessions. All audio- and video-tapes were transcribed verbatim for analysis. The completed workbooks were also collected at the end of each tutorial session. In addition, at the end of each tutorial session a questionnaire was administered to measure children's attitudes toward the tutorial process. Field notes were also used to document formal and informal discussions with the cooperative teachers.

Data Analysis

Analysis of the data was inductive in nature. A coding system used for the analysis emerged from the data. Two researchers and one graduate student read the same transcripts to formulate specific codes and identify appropriate categories. Table 3 presents the categories which were included for analysis with their definitions.

All transcripts were coded using the above coding system. Two researchers and one graduate student coded the data separately. We met regularly to discuss our coding and to agree upon our final categories. Upon completion of coding, the frequencies of the categories were tabulated for each dyad across tasks, for purposes of further comparison. The examination of the frequencies led us to a more in-depth analysis of the interactions within and between dyads across different tasks. This stage of analysis examined the interrelation of categories across different tasks and determined the patterns and themes that emerged from the data. In order to conduct a micro-analysis of the groups' interaction, we further chunked the data into short units of interaction. Interviews, questionnaire and completed worksheets/tasks were also analyzed and triangulated with the findings of the above micro-analysis to confirm the consistency of the results.

We also used quantitative analysis to examine the differences in interaction among dyads across five different tasks. A two-tailed t-test was used to compare the tutors' scaffolding behaviors across tasks.

Results

The results presented here demonstrate some of the patterns that emerged from the analysis of ten dyads. The results are organized according to the questions of the study.

What characteristics of the tutor and tutee are most likely to enhance learning?

The analysis of the data showed that the composition of dyads seemed not to be a significant factor in tutors' and tutees' interactions. Dyads interacted comparably equal across tasks regardless of their ability levels or gender. Task difficulty, however, seemed to be a factor of significance in how tutors and tutees participated in the interaction and completed the tasks (see table 5). Generally the dyads were heterogeneous in ability and were cohesive except for one dyad that could be described as "noncooperative"--tutee would not follow directions and would not respond to the tutor's requests--in most of the tasks. Intra-dyad dynamics revealed no significant differences between dyads with respect to both ability and gender. The cognitive functioning of each dyad seemed determined by the nature of the task and its demands. The types of tasks or learning outcomes seemed to impact on the amount and quality of tutors scaffolding behavior during tutorial sessions.

In-depth analysis of intra-dyads dynamics indicated that tutors were unable to orient the tutees to the task's objectives. They usually began the task immediately after finishing the warm-up activities without either describing the task or introducing the materials. Most often, the only introduction was an abrupt switch to the new task. Although the tutors themselves had access to the day's agenda they usually did not share it with the tutees. This lack of introduction to the task

led to the tutee's puzzlement of what was expected of him or her. The following excerpts demonstrate how tutors with different ability levels began the task.

Task: Measurement
Tutor: Low ability
Tutee: Low ability

Tutor: . . . .Okay, now, we gotta do . . . Okay. Now hold your carrot. Okay. Did you know that this carrot is equal to one foot?
Tutee: No.
Tutor: You didn't! See it. It's equal to a whole foot. Okay, that's equal to a foot. . .

Task: Science (Sink or Float)
Tutor: High ability
Tutee: High ability

Tutor: Okay, get your tin foil, water container, pennies. . . Okay, we got pennies. We need the tin foil. Let's go and get some tin foil.
Tutee: Mmmm. The water smells good.
Tutor: Four. Four different boats out of tin foil. Make them different shapes, size [pause] and sizes [reading from the agenda].
Tutee: What?
Tutor: Don't do that [tutee is touching the tin foil]. Don't mess with that. Okay?
Tutee: Why?
Tutor: Cause, she [teacher] don't want you to. Now we are going to have to make them. Okay? What kind of boat are we gonna do first?
Tutee: Sailboat!
Tutor: How about a little boat first?. . .

During the instruction, tutors also relied more on simple and short commands than on elaborated explanation and demonstration. They often used commands (e.g., "...Come on finish your..."; "[...Let's see how tall the chair is] put that (measuring carrot) to the chair; ";[so you got to measure me. I am a foot higher than you. you're pretty tall] put your foot down") to keep tutees to remain on task and perform appropriate responses. These instructional strategies were also shown by tutors' inability to reformulate and rephrase the guiding questions and instructional directions.

Task: Measurement
Tutor: High ability
Tutee: Low ability

Tutor 4: How many inches is that?
Tutee: Two inch.
Tutor 4: Naa, how many inches is that?
Tutee: Five inches.
Tutor 4: How many inches is that?
Tutee: Six inches.
Tutor 4: Naa, how many inches?
Tutee: Nine, seven inches, three inches.
Tutor 4: Okay, now there is twelve. How many inches is in this whole ruler. . .

Task: Measurement
Tutor: Mid ability
Tutee: Mid ability

Tutor 1: How many?
Tutee: Seven inches.
Tutor 1: You have to name it
Tutee : Seven inches.

Tutor 1: What is it?
Tutee: Seven inches tall.
Tutor 1: What is the name of this? The thing that you're use.....measuring.

Another pattern that emerged indicated that tutors failed to break down or simplify the task in order to reach the tutee's zone of proximal development. In this process tutors appeared to have difficulties perceiving the tutees' level of understanding or competence and providing appropriate guidance. In other words, tutors seemed not to be able to tailor their teaching to the age and competence level of the tutees.

Task: Measurement
Tutor: High ability
Tutee: High ability

Tutor: How many feet. . . how many of these are in a yard? How many of these are in a yard? Look, how many of these big rulers are in a yard? How many of these are in a yard?
Tutee: Five.
Tutor: I told you three. Remember three.
Tutee: Three.
Tutor: Okay. So, how many inches are in this .... this whole ruler?
Tutee: Six.
Tutor: Naa.
Tutee: Twelve.
Tutor: Yaa. How many of these are in a yard.

Task: Play/Build a House
Tutor: High ability
Tutee: High ability

Tutor 2: Okay, what do you think an interrogative sentence is? It is a sentence. Just take a wild guess.
Tutee: Um, uh, um, a poem.
Tutor 2: A poem? In inter [pause] Good that was a good guess. That was very smart. You were close. But an interrogative sentence is when [pause] I think it's a question. interrogative [pause] yeah. Interrogative is a question. [Tutee leaves for a moment to ask teacher a question]
Tutor 2: Okay, interrogative sentence is a question mark. So, this [refers to a sentence on the paper] is a question mark. Okay, find the question sentences [pause, but no response from the tutee] okay. What kind of sentence is this.
Tutee: [Reads from the paper] Will we live in a cave?
Tutor 2: Is that a [pause, waits for tutee to respond, but no respond from the tutee] Is that a [pause, but no respond from the tutee] What kind of a sentence is that?
Tutee: Uhhhhhh.....
Tutor 2: Is that a question mark right there?
Tutee: Yes.
Tutor 2: So, what kind of a sentence is it? Interrogative, right?

It should be noted that although tutors appeared to be less competent in assessing and accessing the tutee's zone of proximal development, they provided a high degree of support and feedback to sustain and build tutee's confidence and motivation. The majority of tutors used humor to encourage tutees to stay on task and follow directions.

Tutor 3: Try it. Don't say you can't cause you can. You always can. The two words I don't like the most. Those are .....my not so favorite words.
Tutee: Why?
Tutor 3: Because everybody can do it.
Tutee: Except me!
Tutor 3: No, everybody knows.
Tutee: The whole wide world?
Tutor 3: Mmmm. Especially you!

Tutee: Why?
Tutor 3: Okay.
Tutee: Why?
Tutor 3: Yaa. Everybody has a good chance.

The analysis of interaction between tutors and tutees showed that tutors were able to keep tutees' on task. However, tutors used strategies such as prompts, hints or positive and negative feedback, confirmation and correction. These strategies were employed in order to urge tutees to respond appropriately instead of giving feedback on the appropriateness of their responses. For example, in the measurement task after several times of asking the same questions, when the tutee is not able to respond appropriately, the tutor uses prompts or hints to help the tutee provide appropriate response instead of providing examples or elaborating on the meaning of the concepts.

What type of learning outcomes are most amenable to cross-age tutoring?

The five tasks which dyads worked on were measurement, house (concepts), two science experiments and map construction (problem-solving). The results of the analysis demonstrate that the quality of interaction was influenced by the types of learning outcomes expected. For example, the concept of *longer*, *shorter* and *the same as* seemed to be easier for tutees to understand than the concepts of *foot*, *inch*, and *yard*. This was because the former concepts are concrete whereas the latter concepts are abstract. In this example, the concreteness of the concept provided an appropriate context for tutors to scaffold tutees in their learning processes. Therefore, the interaction between the tutor and tutee became more fluid: scaffolding seemed to be more successful, leading to more bidirectional than unidirectional interaction. On the other hand, since the concepts of foot, inch and yard were abstract, tutors had more difficulties in scaffolding tutees so that they understood the concepts.

Task: Measurement (longer, shorter, the same as)
Tutor: High ability
Tutee: High ability

Tutor: . . . let's find something that this carrot is longer than. Okay, let's go [they go together to measure] How about this [point to the tape recorder on the table] Is the carrot longer than the tape recorder?
Tutee: Uh huh.
Tutor: Okay, so write tape recorder [tutor helps tutee in writing the word on the worksheet]. Okay, what else [pause] what are we gonna measure?
Tutee: The classroom.
Tutor: How about the card box? Is the carrot bigger?
Tutee: It's way bigger.
Tutor: Okay, let's put the card box here.

Task: Measurement (foot, yard, inch)
Tutor: High ability
Tutee: High ability

Tutor: Now, hey Andy. You know how you have a backyard?
Tutee: Mmhmm.
Tutor: That's [thinks] you could say that if you had three carrots that would equal up one yard. Okay, get that? Okay, so three carrots is one?
Tutee: Yard.
Tutor: Good. Now three, oh one of these carrots is equal to a foot. So, [thinks] so if three carrots [thinks] equal? [pauses for tutee's response, but no response from tutee]. It equals the same thing as three carrots. What?
Tutee: Yard.
Tutor: One yard. Okay, and see if I had thirty six more inches like this [points and waits for tutee's response]
Tutee: Mmhmm [looks confused]

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Tutor: [continues] I would have thirty six inches which is one yard. No [looks confused] yeah, if I had thirty six inches like this I would have one yard. Okay? [Pause for tutee's response, but no response from tutee] So, thirty six inches equal one [waits again for tutee's response]
Tutee: Yard.
Tutor: Good [seems to be convinced that tutee has grasped the concept]. Okay, now we are going to do our work. Okay, John. Three feet equals one [waits for tutee's response]
Tutee: Yard.
Tutor: Okay, and twelve inches equal one [waits for tutee's response]
Tutee: Yard.
Tutor: Nope, twelve inches equal one [waits for tutee's response]
Tutee: Foot.
Tutor: Good, Okay, and what does three feet equal? It equals one [waits for tutee's response]
Tutee: Carrot.
Tutor: No. . .

The analysis of the interaction shows that tutee's prior knowledge was also a factor affecting the quality of interaction. For example, in the problem-solving tasks in which tutees were required to have prerequisite concepts and rules in order for tutors to properly scaffold the task, the interaction became more unidirectional because tutors took over the task. However, in the task of science experiments (problem-solving), although tutees were still required to have prior knowledge of the concepts of *crispy* and *soggy* in order to make predictions, the hands-on activity facilitated the learning process. Again, the concreteness of the hands-on activity provided an appropriate environment for tutors to scaffold the prerequisite concepts (*crispy* and *soggy*) and to prepare tutees to participate in making predictions. In such cases, both tutors and tutees contributed equally to the task at hand.

Task: Science experiment (predict what would happen to the cereals)
Tutor: High ability
Tutee: Low ability

Tutor:. . . We said that the crispiest cereal would be Crispix. Okay, and we said that the soggiest cereal would be Frosted Minie Wheats. . . Let's take this out. Here, put this in here. Feel this. Feel it. So, that would be the soggiest. Is that pretty soggy? Isn't it? It is nasty. Isn't it?
Tutee: Oh, oh.
Tutor: You said this would be the crispiest. So, feel that. Is that crispy or soggy?
Tutee: Soggy.
Tutor: Yeah, see we were wrong about it [she means about their prediction]. . .

On the other hand, when the prerequisite concept was abstract and required more explanation and/or elaboration and examples and non-examples, it was not easy for tutors and tutee to arrive at a shared meaning. In other words, on one hand tutors were not able to make the abstract concepts concrete and on the other hand, tutees had difficulties performing at the desired level of expectation.

The desired goal identified for a particular task of tutoring affected how tutors interacted with tutees. It is important to note that the task difficulty had an effect on how tutors approached the task and how they guided tutees. For example, in a measurement activity where the tutor had to teach a new concept (e.g., foot, yard or inch) which was abstract to a kindergartner, the quality of verbal interaction was low and the level of explanation was very limited. In addition, in such cases the tutor usually terminated the task by either switching to a new task or by completing the task on his/her own.

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What teaching strategies did tutors rely on during their scaffolding process across various tasks?

Table 3 shows the categories that emerged from the data. A two-tailed t-test was conducted using the frequency of each category to identify the significance of teaching strategies used by tutors across various tasks. Table 4 shows the means and standard deviation for each category across tasks. The results derived from the t-test are also presented in Table 5.

The results showed significant differences between the measurement task and the science task (crispy or soggy), $t(11) = 2.33$, $p<.05$ indicating that tutors used more teaching strategies in the measurement task. A significant difference was also found between the science task (crispy and soggy) and the play/build a house task, $t(11) = -2.21$, $P<.05$, suggesting that tutors used fewer teaching strategies in the science task to scaffold than in the play/build a house task. When teaching strategies between the measurement and the map-construction tasks were compared, the results showed that tutors used significantly more explanations, instructional directives, prompts, and redirection in the measurement task. The tutee's number of inappropriate response was also much greater in the measurement task compared to the map construction task.

Similarly, the comparison between the measurement task and the science task (sink or float) revealed that tutors provided more feedback, gave more prompts, and redirected tutees' behavior significantly more often in the measurement task. The same difference was also found between the play/build a house task and the science task (sink or float). The least number of modeling strategies was found for play/build a house task.

Discussion

The incorporation of the qualitative and quantitative analyses in this study was intended to illustrate a more vivid and detailed description of tutors' scaffolding behavior both within and between tasks. The combination of qualitative and quantitative methodologies with its multiple perspectives demonstrates the apparent relationship between the nature of the tasks, task requirements, the tutees' intuitive or prior knowledge and tutors' ability to scaffold.

The results of this study suggest that the older peers can and do assist younger ones' thinking in the course of tutoring as predicted by both Piagetian and Vygotskian theories. However, in contradiction to the typically beneficial results reported in other research, these data indicate that there are some limitations to how tutors can successfully scaffold to maximize tutees' learning.

Research shows that a critical factor in dyadic interaction is the tutor's ability to orient the tutee to the task or provide constructive feedback such as approval or disapproval (Moss, 1992). In this study tutors seemed to be unable to orient tutees to the tasks and provide introductory information that could familiarize tutees with the objectives and procedures of the tasks. The unfamiliarity of tutees with the tasks and their objectives resulted in the tutees repeated inquiries and requests for help which in turn led to a unidirectional interaction. In such interactions tutors would continue with teaching without responding to the tutees' continuous inquiries or initiations. The lack of orientation to the task did not give tutees the opportunity to share their needs/interests in order to help tutors diagnose and provide guidance within tutees' zone of proximal development. Teaching tutees in their zone of proximal development requires that tutors anticipate and plan instruction that is slightly above the tutees' current understanding level. In this study tutors were not able to provide clear explanation and elaboration or examples/non-examples when the concept was too abstract and required verbal definition and explanation. Again, interactions became unidirectional rather than a joint interaction, missing the tutees' input. Tutors were, however, able to scaffold tutees either when the concept was concrete or when the task involved hands-on problem solving.

One reason for the tutors' unsuccessful scaffolding is the discrepancy between tutors' experiences with the task and tutee's level of understanding. For example, when the tutorial task was designed to reinforce fifth graders' learning and the expected outcome was oriented toward their understanding of the task, tutors did not seem to be concerned about how much tutees understood the concept and they often took over the task and completed it on their own.

A second reason could be due to tutors' lack of training. Consistent with previous research (e.g., Corned, 1975; Shafer, Egel, Neef, 1984), this study also suggests that children who are to act as tutors must be trained in certain basic skills if they are to be effective. It seems reasonable that tutors should be given some elementary instruction on how to proceed. For example, children need to be told how to determine when a younger child has a learning difficulty; how to maintain a good relationship with the younger child; how to break down the task into simple steps to facilitate learning; how and when to give feedback; how to a elicit correct response; how to make the young child feel liked and important; and so on. The fact that tutors in this study failed to respond contingently to tutees could be due to their lack of training for their responsibilities. A third reason was the expected outcome. Since the majority of the tasks were outcome-oriented and tutees were expected to complete a worksheet regardless of the complexity of the task, tutors had to use more prompts and commands to help tutees accomplish the task. In their interviews tutors also reported that they had a difficult time helping tutees in abstract tasks (e.g., "I felt it [task] was hard and a little slow [tutee]; . . .It was hard to teach Paul, because he wouldn't listen").

Finally, the study suggests the more abstract the task, the more likely it was that tutees would make errors. This could be due to the fact that abstract tasks require verbal definition and elaboration which tutors may not be able to provide in order to make them concrete . Although fifth graders can be effective tutors, they may not be as effective in scaffolding the abstract task as they are in concrete and hands-on problems. Thus, if cross-age tutoring is to be effective, the tutorial tasks must be selected carefully. The tasks that are more relevant to tutees' level of understanding will be easier for tutors to facilitate. On the other hand, if abstract tasks are to be taught by tutors, they could be given instruction on how to use verbal definitions and examples of appropriate and inappropriate answers in their scuffling process. As the results of this study suggest, the reason hands-on and experimental tasks are easier to facilitate is because they allow tutees to observe and examine the task at hand and to take a more active role in the learning process without requiring tutors to provide verbal definitions and examples during scaffolding.

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Table 1. Tasks Description and Expected Outcomes

Tasks	Measurement	Science /Health	Play/Build a House	Science/Sink or Float	Make an Island with a Treasure
Procedure	• Introduce the concept (foot, inch, yard) • Measure various items existed in the classroom • Complete the worksheet	• Count three types of cereals • Make three cups of milk ready • Add cereals to the cups • Make prediction (which is the soggiest and which is the crispiest) • Examine the results • Record the results • Complete the worksheet	• Choose the finger puppets (bear puppets) • Read the play • Review questions in the play • Draw pictures • Build a house with toothpicks	• Build a boat out of tin foil (use different shapes and sizes) • Make prediction (which boat will float the longest) • Discuss the designs of the boat • Conduct the experiment • Build a clay boat (for comparison) • Compare clay boat with tin foil boats	• Discuss the pirate day (what to wear, what kind of pirate you would be) • Construct a map (include map key) • Use 5 geography themes (location, interaction, region, movement, description) to describe the map • Present the treasure map
Tutor's Expected Outcome	Practice measurement: 12 inch = 1 foot 3 feet = 1 yard 36 inches = 1 yard	Generate a bar graph	Design a house (be an architect)	• Design a boat • Design an experiment • Conduct the experiment • Report the results • Complete the worksheet • Discuss the design with other classmates	• Construct a map with a map key • Apply five geography themes
Tutee's Expected Outcome	• Measure the item • Record the results • Complete the worksheet	• Make prediction • Test hypothesis • Make observation • Record the results	• Answer the questions • Draw pictures • Help with building a house	• Participate in designing boats • Participate in designing and conducting the experiment • Make prediction by weighting the boats • Observe the results	• Decide on the type of pirate and the costume • Participate in the process of map construction • Participate in the process of drawing and discussing the treasure location

Table 2. Schematic model of the overall design

		Competence Level				
Subject	**Gender**	**High High**	**Mid-Mid**	**Mid-Low**	**Mid-Low**	**High-Low**
Anglo-American n=21	F(9)	5	2			2
	M(8)	5	2		1	
African-American n=3	F(2)			2		
	M(1)				1	

Table 3. Definitions and examples of peer mediated teaching strategies

Codes	Definition (Examples)
Explanation (EX)	Tutor provides explanation to make something clear. This could be about the tutee's behavior or the activity itself (e.g., "It looks like a horse shoe", "Oh, this is what we have to do...our agenda...which means what we have to do today").
Inquiry (IQ)	Tutor asks the tutee to produce some kind of information. (e.g., "What is this called?", "What is taller than this letter"; "What do you think it will happen if you put one more penny in the boat(foil)?"
Prompt (P)	Tutor provides specific suggestions for the tutee to do the next response (e.g., "Okay, and the letter after that..", "Okay, next"; "Do you see these letters, can you find one that looks like this one").
Feedback (F)	Tutor provides confirmation, correction, positive or negative feedback to tutee (e.g., "Okay"; "No, it is not an M, it's an N"; "Good girl, that was nice"; "No", "That won't work")
Redirecting (R)	Tutor reorients or redirects tutee to the main task (e.g., Okay, now let's get back to this, how many....")
Demonstration/Modeling (M)	Tutor verbally or nonverbally models/demonstrates for the tutee how to perform/solve something (e.g., tutors make an L by gesturing).
Instructional Directives (ID)	Tutor instructs or commands the tutee how to perform the appropriate response (e.g., "Write an I here, Sarah"; "Answer my question"; "You got to do another one, L. L., Amy", "let's do the book", "How about coloring this in brown"; "You just gotta put that little mark right here" [while pointing]).
Tutee's Response a) Tutee's Appropriate Response (TAR) b) Tutee's Inappropriate response (TIR)	Tutee responds to the tutor's question, direction, or request (e.g., Writes the letter L after being told by the tutor; answers tutor's question) Tutee responds incorrectly to the tutor's question, request, direction, command (e.g., Tutee writes L instead of I).
Tutee's Request for Help or **Asking for Confirmation** (TAH/TAC)	Tutee asks tutor for help (e.g., "What looks like a D? "Where is it?"). Or may ask for confirmation (e.g., "Like This?")
Tutee's Refusal of Help (TRH)	Tutee refusing tutor's help (e.g., Tutee: "I want to do it..".)
Tutee Gets Off-Task (OT)	Both tutor and the tutee are discussing something that is not related to task on hand (e.g., "What did you do yesterday?").

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Table 4. Mean and standard deviation of variables across different tasks

Variables	Tasks				
	Task 1 Measurement M (SD)	Task 2 Science/ Health M (SD)	Task 3 Build a House M (SD)	Task 4 Science/Sink or Float M (SD)	Task 5 Treasure Island M (SD)
Explanation	11.7 (7.8)	9.6 (7.9)	11.2 (5.2)	7.9 (4.2)	10.1 (7.8)
Inquiry	26.9 (19.4)	20.5 (11.7)	17.0 (12.1)	14.8 (9.0)	16.9 (11.6)
Instructional Directives	33.4 (22.3)	27.5 (20.4)	25.8 (16.1)	30.7 (23.7)	21.2 (18.0)
Feedback	36.4 (20.5)	18.8 (14.3)	21.1 (12.2)	9.4 (6.3)	13.7 (11.4)
Modeling	5.4 (5.1)	4.6 (3.1)	2.7 (2.3)	5.4 (3.6)	7.4 (5.1)
Prompt	23.3 (11.8)	4.6 (5.7)	15.1 (13.3)	1.3 (1.6)	1.0 (0.9)
Redirection	5.0 (3.3)	2.8 (3.1)	3.1 (4.1)	1.9 (3.1)	2.3 (2.4)
Tutee's Appropriate Response	26.9 (25.1)	18.1 (8.4)	19.9 (14.8)	16.6 (10.3)	14.2 (11.5)
Tutee's Inappropriate Response	17.0 (13.4)	4.5 (3.8)	9.7 (6.7)	5.8 (5.0)	4.4 (5.6)
Tutee Asking for Help	7.6 (5.0)	8.5 (8.1)	8.8 (6.3)	7.0 (5.0)	7.8 (6.9)
Tutee Refusing Help	0.7 (1.5)	0.6 (1.2)	0.00 (0.0)	4.9 (6.7)	3.3 (5.0)
Tutee Gets off Task	2.4 (3.5)	4.1 (3.5)	3.6 (2.1)	3.3 (2.4)	4.9 (4.8)

Table 5. t values of all significant variables across various tasks

Variables	Task 1 vs. 5 T Value	Task 1 vs. 2 T Value	Task 1 vs. 4 T Value	Task 2 vs. 3 T Value	Task 3 vs. 4 T Value	Task 3 vs. 5 T Value
		2.3*		-2.2*		
Explanation	3.5**					
Instructional Directives	2.5*					
Feedback	3.7**		3.1*		3.7***	
Modeling						-2.4*
Prompt	5.0***	3.7**	4.7***		3.6**	3.0**
Redirection	5.2***	2.2*	3.0*			
Tutee's Inappropriate Response	2.4*	2.4*	2.8*			

* = $p < 0.05$
** = $p < 0.01$
*** = $p < 0.001$